

24th, Saint Vincent, Minn.; Ardenia, N. Y. 25th, Gardiner, Me. 27th, Pekin, Ill. 28th, Palermo, N. Y.

THUNDER-STORMS.

Thunder-storms occurred as follows: Mobile, Ala., 1st; Alcatraz Island, Angel Island, Oakland, Presidio of San Francisco, and San Francisco, Cal., 4th; Red Bluff, Cal., 23d; Titusville, Fla., 1st; Limona, Fla., 18th; Savannah and Quitman, Ga., 1st; Globe and Salina, Kans., 5th; Manhattan, Kans., 6th; Liberty Hill, La., 15th; Conception, Mo., 4th; Pierce City, Mo., 6th; Charleston and Stateburg, S. C., 1st; San Antonio, Tex., 12th; Cedar Hills, 14th; Palestine, Tex., 18th.

ELECTRICAL PHENOMENON.

Fort Assinaboine, Mont.: there was a constant display of light on the wires during the storm of the 11th, and the wires in the telegraph office became almost unmanageable.

Huron, Dak.: during the storm of the 12th metals and other substances emitted electrical sparks. Severe shocks were felt by persons shaking hands.

Fort Maginnis, Mont.: during the storm of the 12th the atmosphere was very highly charged with electricity from 3 p. m. until midnight, interfering considerably with the working of the telegraph lines; upon touching any metallic surface shocks were felt.

MISCELLANEOUS PHENOMENA.

METEORS.

Orono, Me.: a meteor, apparently about one-fourth the size of the moon, was observed at 6.40 p. m. on the 4th; it started near the zenith and moved in direction south 40° east, disappearing when within about 40° of the horizon. Although the sky in the region of its path was cloudy at the time it illuminated the horizon with a bright light.

Fort Sill, Ind. T.: an unusually bright meteor was observed at 8.45 p. m. on the 4th; it started from about 75° above the southwest horizon, moved a little to the southwest, and disappeared when at an altitude of about 30°; during the passage of the meteor the southwestern sky was illuminated as though the full moon shone; it was visible for ten seconds. This meteor was also seen at Fort Reno, Ind. T., and was probably the same seen at Abilene, Tex., and Yates Centre, Kans.

Meteors were also observed as follows:

1st, Wythville, Va. 2d, Webster, Dak., and Yates Centre, Kans. 4th and 6th, Rappahannock, Va. 7th, Wytheville and Dale Enterprise, Va. 9th, Tribune, Kans. 10th, Lamar, Mo.; Woodstock, Md.; Dale Enterprise, Va.; Rappahannock, Va. 11th, Woodstock, Md.; Dale Enterprise, Va. 12th, Nashua, N. H.; Wytheville, Va.; Fort Stanton, N. Mex. 13th, Lead Hill, Ark., and Manhattan, Kans. 14th, Provincetown, Mass. 20th, Fall River, Mass. 23d, Dubuque, Iowa. 24th, Wytheville, Va. 27th, Washington City and Chicamcomico, N. C. 28th, Omaha, Nebr., and Woodstock, Md. 30th, Grand Junction, Colo. 31st, Variety Mills, Va.

MIGRATION OF BIRDS.

Geese flying southward.—Yates Centre, Kans., 1st, 3d; Chattanooga, Tenn., 3d; Kitty Hawk, N. C., 10th; Wilmington, N. C., 11th, 20th; Red Bluff, Cal., 23d.

Geese flying northward.—Red Bluff, Cal., 10th; Corsicana, Tex., 14th; Augusta, Ga., 21st, 27th; Globe, Kans., 29th.

Brants flying southward.—Kitty Hawk, N. C., 10th.

MIRAGE.

Corpus Christi, Tex.: at 3 p. m. on the 2d Mustang Island, twenty-two miles from this place, was plainly seen on the horizon, over Corpus Christi Bay; the phenomenon continued until 5 p. m. A similar display was observed from 11 a. m. to 4 p. m. on the 27th.

Fort Maginnis, Mont.: Mason Lake and its surroundings, situated about forty miles distant, were plainly seen from 9.45 to 10.45 a. m. on the 23d.

Webster, Day Co., Dak.: unusually fine displays of mirage were observed on the 29th and 31st; on the first-named date, Wobbay, and on the latter, Bristol, and their surroundings, were plainly seen.

Mirages were also observed as follows: Garden City, Dak., 29th; Cedar Keys, Fla., 21st; Tribune, Kans., 1st, 2d, 3d, 10th, 11th, 17th to 19th, 23d, 25th, 26th, 29th, 31st; Fort Maginnis, Mont., 23d; Poplar River, Mont., 14th, 17th, 20th, 21st, 28th, 29th; Marquette, Nebr., 2d, 10th, 18th, 26th, 29th to 31st; Corpus Christi, Tex., 28th.

PRAIRIE FIRES.

Fort Sill, Ind. T., 2d; Fort Reno, Ind. T., 4th.

SAND STORMS.

Willcox, Ariz., 3d, 4th, 10th; Fort Grant, Ariz., 4th, 10th, 18th.

SUN SPOTS.

Mr. H. D. Govey, North Lewisburg, Champaign Co., Ohio, observed sun spots as follows: 1st, 2d, 10th, 13th, 14th, 18th, 21st.

VERIFICATIONS.

CAUTIONARY SIGNALS.

Of the total number of cautionary and storm signals ordered during January, 1888, it was practicable to determine the justification or failure of fifty-four; justified, thirty-seven, or 68.52 per cent. Of the above, twelve were ordered for cautionary signals; number justified, seven, or 58.33 per cent. Forty-two storm signals were ordered; justified, thirty, or 71.43 per cent. Total number of direction signals ordered, fifty-six; justified, fifty-four, or 96.43 per cent. Number of signals ordered for easterly winds, eleven; justified, ten, or 90.99 per cent. Number of signals ordered for westerly winds, forty-five; justified, forty-four, or 97.78 per cent. Number of storms without signals, none. Number of signals ordered late, *i. e.*, after the justifying velocity had begun, twelve, or 22.22 per cent.

COLD-WAVE SIGNALS.

Total number of cold-wave signals ordered from Office Chief Signal Officer, two hundred and sixty-one; justified, one hun-

dred and eighty, or 68.97 per cent. Eighty-one cold-wave signals were ordered during the month by the Signal Service Officer at Saint Paul, Minn., of which, seventy-five, or 92.59 per cent., were justified.

INDICATIONS FOR 33 HOURS IN ADVANCE.

The percentages of verifications of the tri-daily indications for January, 1888, as determined from comparison of succeeding telegraphic reports are given in the table below.

The predictions for all districts east of the Rocky Mountains for January, 1888, were made by Junior Professor H. A. Hazen, except those for Minnesota, eastern and central Dakota, which were made at Saint Paul, Minn., by 1st Lieutenant Thomas M. Woodruff, 5th Infantry, U. S. Army, Acting Signal Officer; those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps; the verifications for all districts were determined by Junior Professor O. F. Marvin: